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DRIVERS' PERCEPTION OF SAHER TRAFFIC MONITORING SYSTEM IN
JEDDAH, SAUDI ARABIA

A Thesis
Presented to
The Faculty of the Department of Architectural and Manufacturing Sciences
Western Kentucky University
Bowling Green, Kentucky

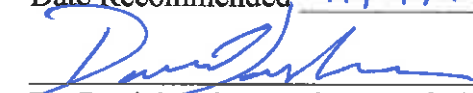
In Partial Fulfillment
Of the Requirements for the Degree
Master of Science

By
Yaseen Jan

December 2014

DRIVERS' PERCEPTION OF SAHER TRAFFIC MONITORING SYSTEM IN JEDDAH,
SAUDI ARABIA

Date Recommended 11/4/14


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DRIVERS' PERCEPTION OF SAHER TRAFFIC MONITORING SYSTEM IN JEDDAH, SAUDI ARABIA

Yaseen Jan

December 2014

54 Pages

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This study examined the drivers' perception of the SAHER (means "watchful" in Arabic) system in Jeddah, Saudi Arabia. The purpose of this study was to analyze the perception of the SAHER system on impacting the overall traffic conditions in Jeddah, Saudi Arabia including its effectiveness and flaws. A survey was conducted and distributed to 70 drivers and residents of Jeddah. Drivers were divided into two groups based on their age. Five hypotheses were tested in this study. Hypotheses one through four were tested using the averages of related questions. Hypothesis five was tested statistically using a z-test for differences between the means. The overall conclusion of drivers' perception of SAHER on increasing road safety and reducing loss of life was generally positive. The conclusion for hypothesis 1, 2, and 3 was positive. The conclusion for hypothesis four was inconclusive. The conclusion for hypothesis five was retained to the null hypothesis with a 95% confidence level. A key recommendation from the study is that to measure the overall effectiveness of the system it will be prudent to observe how the system is perceived in other major cities of Saudi Arabia apart from Jeddah.

INTRODUCTION

In 2009, the Kingdom of Saudi Arabia launched a traffic control system called SAHER, which in Arabic means, “watchful”, and stands for the “*Automated Traffic Violations Administering and Monitoring*” program. The purpose of SAHER was to minimize accidents and maximize overall traffic efficiency throughout the kingdom. It includes the deployment of an intelligent transportation system, using the latest technology in traffic enforcement, traffic management sub-systems, and services to enhance safety on roadway networks. SAHER accomplishes this by optimizing the transportation infrastructure, attempting to decrease fatality rate, and improving road congestion. The system uses a digital camera network connected to and monitored by, the National Information Center of the Ministry of Interior (NIC).

Key functions of SAHER are categorized as follows:

- Traffic Management System (TMS)
- Auto Vehicle Location (AVL)
- License Plate Recognition (LPR)
- Monitor Closed Circuit TV (CCTV)
- Law enforcement System (LES)

The overall goals of the program are as follows:

- To implement the country’s traffic rules both efficiently and effectively.
- To increase driver and residents safety and enhance road safety by making sure that the driving conditions on the road are not hazardous and any problems are addressed immediately.

- To assist the police force in monitoring traffic violations impartially and maintaining road safety.

Problem Statement

On average, 17 Saudi Arabian residents, primarily male, die on the country's roads each day as reported by the Kingdom's General Directorate of Traffic. This news comes after the World Health Organization (WHO) found Saudi Arabia to have the world's highest number of deaths from road accidents per capita, which account for the country's principal cause of death in adult males aged 16 to 36 (World Health Organization , 2009).

Furthermore, as reported by the Saudi Daily Arab News, there were 6,485 traffic fatalities and more than 36,000 injuries in over 485,000 traffic accidents in 2008 and 2009. Though there was no official reaction to this unfortunate and manmade epidemic, Saudi analysts pointed to a larger underlying problem (Arab-news, 2011).

"The driving problems are with young people," Ali Abdul-Rahman Al-Mazyad, a Saudi columnist in Riyadh told media (Asharq al-Awsat newspaper). "There are very little outlets for young people to enjoy themselves and kids basically do what they want." "There is also no education in schools about safe driving and respecting the road," he said. "Drug use is also a contributing factor. These are the central problems." The report found that almost a third of traffic accidents in the Saudi capital Riyadh were due to drivers proceeding through red lights, followed by 18 percent of accidents caused by illegal U-turns. The most common dangerous driving activities were speeding, sudden stops and speaking on the phone while driving (Dangerous Roads Organization, 2013). Silvio Saadi, a Jeddah-based businessman and film producer, argued both government

and an out-of-control youth culture were to blame. “You won’t believe what you see,” he told media. “It’s just crazy.” “Saudis often try to drive outside the road with their cars and there are thousands of pedestrians on the sides of the street,” he said, referring to an informal motor sport in which drivers intentionally over-steer so as to lose traction and drift on the road. “Sometimes the car drifts into the pedestrians, slamming them into buildings along the sidewalk.” Saadi said while the government has taken some initiatives, they have fallen short of an aggressive road safety campaign to protect the average resident. To make matters worse, “outside the city, the police often cannot stop them,” he said. “The police are actually scared because they are outnumbered on the street. A few years ago the government built a Jeddah raceway to attract young people to race on the track instead of on the streets, but people still like to do it the old fashioned Bedouin way.” (Dangerous Roads Organization, 2013).

The responsibility of protecting Saudis and residents on the road lie with the Ministry of Interior’s Department of Traffic and the challenges are enormous. For example, statistics show that a crippling or disabling injury occurs every 15 minutes and an astronomical 3.5 billion USD is spent annually in addressing damages to property and loss of productivity (Ministry of Interior in Saudi Arabia).

Purpose of the Study

The primary purpose of this study was to analyze the perception of the SAHER system on impacting the overall traffic conditions in Jeddah, Saudi Arabia including its effectiveness and flaws. Jeddah is one of the important cities in Saudi Arabia, it is located in the middle of eastern coast of the red sea, and is considered the economic and tourism capital of the country. Its area is more than 70 km from the south to the north and 50 km

to the east. The population of the city is around 4 million. Though this advanced technology is supposed to mitigate the traffic problems and accidents in Saudi Arabia, it is wishful thinking to assume that SAHER alone will solve all the traffic problems that has manifested over the last several decades. Saudi Arabia is a highly bureaucratic country and there were many obstacles to overcome in order to successfully implement this game changing technology and program. The first challenge was the Saudi culture, which in a conservative society and can be extremely difficult to change. In order to change the mindset of an average citizen or resident, leadership and support had to come from the very top. In this instance, King Abdullah himself had to be involved in the decision making process.

In spite of the support from the ruling family, there seems to have been serious resistance against the SAHER system. As a result of this, the implementation and operation of enforcement systems has been negatively impacted by such activities as arson and vandalism. Acts such as these showed that the population had to be educated on the benefits of the system and those that misused public property were severely punished. Another challenge that had to be overcome was the Saudi bureaucracy. By western standards, the implementation of SAHER, in some instances was excruciatingly bureaucratic and time-consuming. Two major obstacles were the timely acquisition of construction permits and the re-engineering of the roadways and intersections necessary to install enforcement and traffic management systems. This was further validated by listening to the business community in Saudi Arabia, who were involved in the implementation of SAHER. They clearly stated their frustration with the government in getting the work done on a timely manner. For example, in 2009 a major newspaper in

Saudi Arabia published a front page story detailing the frustration of the business community against the Saudi government.

The impact of SAHER system is viewed both positively and negatively by the Saudi society today. In this study, strengths and weaknesses of the SAHER system were analyzed and suggestions were made on how the system can be made even more favorable to the public, resulting in less traffic fatalities and increased safety for drivers and residents.

Thesis Statement

Overall, the SAHER system has had a perceived positive impact on increasing road safety in Saudi Arabia. It is perceived by Saudis as helping to reduce loss of life and property damage, and has increased the productivity of traffic law enforcement agencies and individuals.

Hypothesis

For the purpose of this study, the following hypotheses were tested to determine perception. Hypothesis one through four were tested using the averages of related questions. Hypothesis five was tested statistically using a z-test for differences between means, hence the articulation of the null and alternate hypotheses.

Hypothesis 1: SAHER has had a perceived influence on drivers in Saudi Arabia following safe driving rules.

Hypothesis 2: Saudi drivers perceived SAHER as helping Saudi police apprehend and punish traffic safety violators effectively.

Hypothesis 3: Saudi drivers perceived SAHER as a reliable system throughout those locations where implemented within the country.

Hypothesis 4: Saudi drivers perceived SAHER as having technical limitations where drivers may take advantage.

Hypothesis 5:

Ho5: There was no difference in overall perception of SAHER between the two age groups. Statistically this was represented as Ho5: $\mu_1 = \mu_2$.

Ha5: There was a difference in perception of SAHER between the two age groups.

Statistically this was represented as Ha5: $\mu_1 \neq \mu_2$.

Assumptions

The following assumptions were made while conducting this study:

1. The survey questionnaire distributed resulted in accurate, random, and non-biased data.
2. The sample that was collected represents the population.
3. Participants were familiar with SAHER to the extent that their responses from the survey will possess some validity.
4. Participants reported truthful perception while completing the survey.

Limitations

The Saudi government has collected data on traffic accident fatalities but does not have data on the impact and perception of the SAHER system on drivers and residents.

Delimitations

The study had the following delimitations for its completion

1. The study focused on the city of Jeddah and how the SAHER system was perceived in that one city.
2. The study was not collected data from rural Saudi Arabia.

3. Fatality data were not reported.

Definition of Terms

KSA: Kingdom of Saudi Arabia

NIC: the National Information Center of the Ministry of Interior

SAHER: Automated traffic control and speed management system

ATVAM: Automatic Traffic Violation Administrating and Management system

TMS: Traffic Management System (TMS)

AVL: Auto Vehicle Location (AVL)

LPR: License Plate Recognition (LPR)

VMS: Variable Message Signs (VMS)

CCTV: Monitor Closed Circuit TV (CCTV)

LES: Law Enforcement System

LITERATURE REVIEW

The primary literature review for this project was done by reviewing countries that had implemented similar traffic technologies and their resulting impact. Obtaining primary data from the Saudi Arabia government was extremely difficult as the Saudi government maintained a very insular position on sharing it. Direct information collected regarding the impact of SAHER system in Saudi Arabia came from regional public databases such as the Ministry of Interior of Saudi Arabia.

Dalla Albaraka is a Saudi Company founded in Riyadh, the capital of Saudi Arabia in 1969 by its owner Sheikh Saleh Kamel. Dalla Albaraka influences almost every sector of economic life, including trade, real-estate, healthcare, finance, transportation, maintenance, and operation. Dalla Albaraka is well-known and very popular in the Middle East, and it is considered one of the largest companies in Arab countries. In the last ten years, the group ranked number five in the top 100 Saudi companies. Dalla Albaraka Company launched the idea of the SAHER system in Saudi Arabia and is responsible for operation of the SAHER system in the western region of Saudi Arabia, including the city of Jeddah (Dallah.com).

SAHER project has gained three (ISO) international certificates as follows:

1. ISO 27001-ISMS: (Information Security Management Systems).
2. ISO 9001 –QMS: (Quality Management Systems).
3. ISO 20000 –ITSM: (Information Technology Service Management).

SAHER uses laser and radar systems to catch violators. In the city of Jeddah, SAHER uses the radar system only. This system, called Multanova, is the same name of the company that produces this system as well. The Multanova Company was

established in 1952 in Switzerland and is known in the traffic monitoring industry as one of the first companies to supply radar speed monitoring systems with photographic recording. Multanova offers solutions for red light and speed monitoring in road traffic (Multanova.ch). Figures 1 represents SAHER camera on a high-way. Figure 2 represents SAHER camera on traffic light. Figure 3 represents the cycle of violations.

Mechanism of monitor violations:

1. Speed violation:

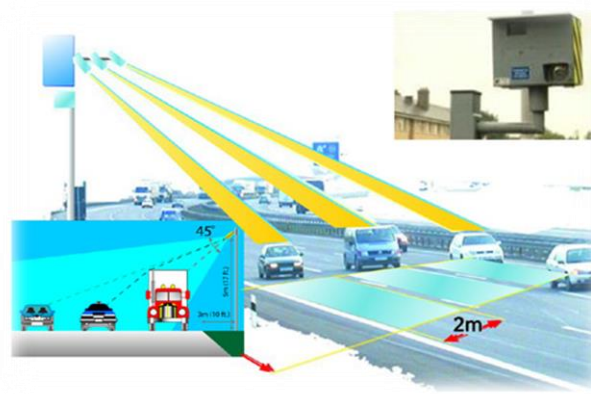


Figure1. SAHER camera on a high-way

The SAHER cameras on the high-way provide the following service:

- Takes a clear picture of the plate even in high speed.
- Works 24 hours.
- Captures images of the cars in different lanes.

2. Violation in traffic light:

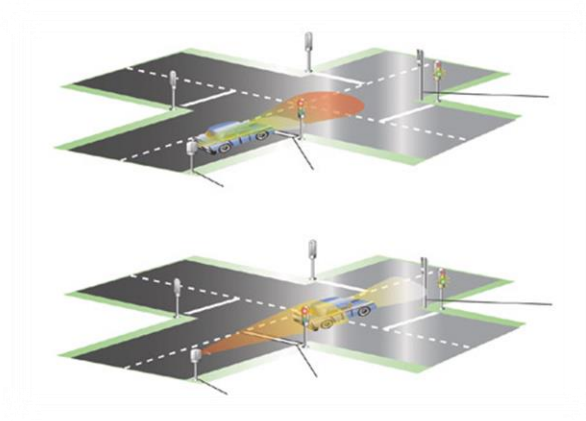


Figure2. SAHER cameras on traffic light

The SAHER cameras on traffic light provide the following service:

- Catch individual running traffic lights.
- Capture pictures of front and rear plate

Cycle of violations:

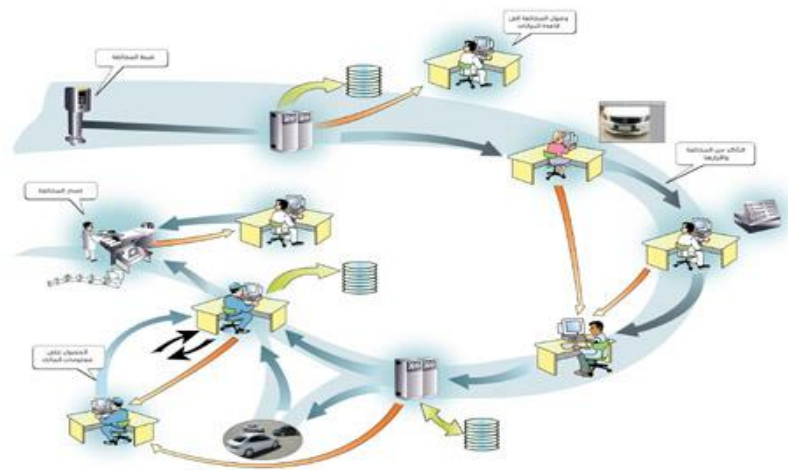


Figure3. Cycle of violations

Cycle of violations is processed in the following ways:

- Picture of plates will be sent to violation processing center.

- At the center, employees make sure that the violation took place and they approve it.
- Take violator's information from national database.
- After that, violations are issued.
- A text message will be sent to the violator to their mobile device.
- Then, violators can pay their tickets through ATM machines.

Taking into consideration the difficulty of obtaining primary data, this review focused on the impact of similar technologies in other countries and regions. One of the pioneers in the analysis and effectiveness of traffic signal enforcement systems, Troy D.Walden (Walden, 2011) has studied the evaluation of photographic traffic signal enforcement systems in Texas, USA. It was a similar system in comparison with the SAHER system in Saudi Arabia. There were 275 monitored signal controlled intersections from around the state that were considered in this evaluation. For example, one year observations were comprised of 83 monitored locations that possessed a single year of crash data on each side of the system activation date. The two year groups were made up of 139 intersections that had two years of crash data on each side of the system activation date and the three year groups were comprised of 53 intersections with three years of crash data on each side of the system activation date. From those intersections, 15,144 identified crashes were located in the Crash Records Information System (CRIS). A total of 11,122 crashes took place within the intersections. Of those crashes, 5,869 crashes occurred before “automated traffic enforcement systems” were activated. After the system was installed, a total of 5,253 crashes occurred. The number of crashes has decreased by 616 events. While there is little available data for the cost of the traffic

signal enforcement system, red light running problem cost Texas taxpayers approximately USD 2 billion annually prior to installation of the traffic signal enforcement system. It is just one of the cost-value benefits resulting from the commissioning of these systems (Walden, 2011). Texas Department of Transportation claims that, the installation of a red light camera can cost more than USD 100,000. However this can be recovered through red light violations captured by cameras. Thus it offers a cost effective benefit (Texas Department of Transportation, 2013). Table 1 shows a summary of comparison of crashes before and after installation of Monitored Signal Intersections in Texas, USA.

Table 1. Summary of Comparison of crashes before and after installation of Monitored Signal Intersections in Texas, USA.

	Before	After	Frequency Difference	Percentage of change
1 year intersection	2,924	2,742	-182	-6%
2 year intersection	2,246	1,837	-409	-18%
3 year intersection	699	674	-25	-4%
Total	5869	5253	-616	-28%

These intersections were evaluated based on the assessment of crash rates at each intersection within each individual community across the state. The red light related crash data were collected for the year prior to the installation of photographic red light traffic

signal and the year following the same and were compared to determine the exact number of reduction in red light related crashes (Walden, 2011).

Another study that reflected the impact of cameras on the road was conducted in the United Kingdom by Richard Allsop (2010). Allsop has a longstanding involvement in road safety research, traffic management, and transport policy. Allsop published a review of evidence regarding the effectiveness of speed cameras. In Britain, speed cameras, introduced in 1992 on the recommendation of the Road Traffic Law Review Report (Department of Transport & Home Office, 1988), expanded rapidly between 2001 and 2005, and has remained widespread since then. The results of the review indicated substantial reductions in the numbers and severity of accidents and casualties (London Accident Analysis Unit, 1997).

A key example Allsop made was the evaluation of the West London demonstration project (London Accident Analysis Unit, 1997). The project observed changes in numbers of collisions and casualties over West London, using the rest of the city as a control area. For example, on the 85 KM of trunk roads in West London, 21 speed cameras and 12 red-light cameras were operational for three years from October 1992. The number of collisions and casualties in those three years were compared with numbers in the preceding three years. The comparison was made for two sets of roads. In the three years of cameras being operational, this study revealed 226 fewer fatal or serious collisions and 265 fewer people from being killed or seriously injured on the trunk roads in West London than would have been expected from numbers on trunk roads in the rest of London. Periodic surveys, done primarily to get a view on the acceptance of the speed cameras, indicated a steady increase in the acceptance of them as a vital tool to

avoid fatal accidents. This average percentage figure for the surveys was around 85 % of the speed and the percentage of drivers exceeding this speed. The overall finances of this initiative over a four year period ending March 2004 indicated the 35 companies involved in England and Wales installing and managing these systems earned around USD 189 million resulting in a profit of approximately USD 36.2 million for the taxpayers. The cost of commissioning of these systems was effectively paid by the traffic offenders' fines explaining the financial success of this traffic enforcement system (Allsop, 2010).

In Qatar, a neighboring Middle East Country to Saudi Arabia, researchers at Weill Cornell Medical College in Doha (WCMC-Q) have found a dramatic decrease in fatal motor injuries following the deployment of speed cameras. Most speed cameras in Qatar were installed during 2007. In 2007 Redflex Traffic Systems supplied over 80 red-light cameras to the State of Qatar's Ministry of Interior for deployment at key intersections in the capital of Qatar, Doha, at a cost of USD 4.2 million. It was followed in the early part of 2009 with an additional order for 24 red-light speed camera systems which were added to the established network, as part of one of the largest road safety campaigns in the region. A Project concluded by researchers in Qatar about speed camera deployment in Qatar indicated before the implementation from 2000-2006, the mean vehicular injury death rate per 100,000 was 19.9 ± 4.1 . After cameras deployed from 2007 to 2010, mean vehicular death rates dropped to 14.7 ± 1.5 . This study strongly indicated how effective policy and efficient implementation can save lives. The Qatar government proposes to invest approximately USD 70 billion in creating a world class transportation network in Qatar. Traffic management systems shall constitute a key component of this investment (ITS International, 2012).

Research conducted by The Scottish Government in 1998 found the installation of camera equipment at signalized junctions in Glasgow in 1991 has resulted in a reduction of red light running and associated accidents at the camera sites. Research covered the period 3 years before and after the 3 years deployment. After the deployment, the reduction of red light running accidents accounted for 20% of the decline. The cameras accounted for 44% of the reduction in personal injury accidents. A cost benefit analysis was made by estimating the cost of purchasing and operating the camera system compared with the reduction in accident costs. It was estimated over a 20 year period (adjusted for inflation) the present value of the project was USD 1.67 million in comparison to total costs of USD 756,000 (The Scottish Government, 1998).

In Singapore the Expressway Monitoring and Advisory System (EMAS) launched in 1998, is used to manage incidents and obstructions on the expressways (Land Transport Authority) of Singapore. Singapore Technologies Electronic & Engineering Ltd designed and implemented EMAS with an incurred cost of USD 9.5 million (Yel, 2001). As part of a long-term plan by the Land Transport Authority (LTA), EMAS provides up-to-date traffic alerts and reduces traffic congestion caused by accidents on the expressways. By 2001 the entire 150 km length of Singapore's expressway was tracked by EMAS.

EMAS uses a network of cameras to monitor vehicle speed and obstructions. This information is then sent to control centers where the information is verified by the operators with the help of surveillance cameras. The traffic police and the radio and television stations are alerted immediately. The motorists are told about the nature of problem and the time they will take to reach the selected locations. All the electronic

signboards on that particular expressway and the roads leading to that expressway flash the messages. The motorists benefit from this technology as they get immediate help in case of accidents and breakdowns. The display of messages to the public helps in minimizing congestion by asking motorists to avoid those areas. EMAS also helps improve the safety of roads. It provides the exact information of travelling time from the entry point of expressway to selected exits. It gives traffic information on other expressways through electronic signboards (One Monitoring.com).

In the 1970s, Sydney Australia adopted SCATS (Sydney Coordinated Adaptive Traffic System) to regulate the heavy inflow of traffic on its roads .SCATS uses a network of computers including a central computer, 11 remote minicomputers and 1000 microcomputer traffic signal controllers distributed throughout the 1500 square kilometer of Sydney Metropolitan area. This network of computers monitors the flow of traffic at each intersection in real time and gathers data. They send these data to the central computer through the traffic signal controllers. The central computer then evaluates the traffic flow at each intersection and then makes the required adjustments in the traffic signals .SCATS ensures a reduction in delays and helps the flow of traffic. Sims and Dobinson study, done on the trial of SCATS in 1974 on Prince Highway Newton on 2.6 km arterial of Sydney, showed a significant decrease in travel time. During morning peak period , a decrease of 39.5% was noted,14.5% reduction was observed during the peak business hours and a 32.8% decrease was seen during evening peak hour period (Sims and Dobinson, 1980). SCATS helped in reducing travelling time and decreased the rate of accidents. SCATS also helped in reducing fuel consumption by 3000 liters annually and, hence, air pollution. SCATS became useful in road planning and design leading to

cost saving. SCATS was positively perceived by the people of Australia as it reduced travelling time.

In France, Morpho (SAFRAN group) implemented fixed and mobile automated digital cameras in multiple phases from 2003 to 2008. The research on the fatalities data due to traffic accidents has shown a 51% reduction in 10 years. National average speeds have also fallen as much as 12% between 2002 and 2009. Public perceptions for this system have been considerably higher at a level of 70%. Penalties for offenders have enabled companies and authorities to recoup almost 2.5 times their investment on these systems (ITS International.com).

In Sweden, the introduction of Speed Enforcement Cameras (Sensys Traffic) has reduced fatalities and seriously injured by 10%. In addition, the scientific approach to observe the speeds at times of collision have allowed the authorities to set up speed enforcement limits accordingly. Next the deployments of cameras in Sweden have allowed a 30% reduction in road fatalities across all types of accidents (ITS International.com).

In Canada, the city of Edmonton in the Province of Alberta understood the need for the installation of the road safety cameras in 1999. It took nearly 10 years for the authorities to pass legislation to allow the imposition of fines for offenders identified by these cameras. It facilitated the upgrade of cameras to handle speed and red light infractions from American Traffic Solution (ATS). Immediately, intersection injury collisions decreased by 124 and fatalities decreased from 15 to 13 from November 2009 to 2010. It was fair to conclude these systems have facilitated an overall increase in the road safety (ITS International.com).

In UK, Vysionics SPECS average systems have been deployed in over 250 sites to ensure speed control over traffic. It has reduced fatalities and seriously injured casualties by over 70%. The definition of speed zones on the expressways have facilitated public acceptance of these systems as they ensure a reliable, congestion free experience for the commuter (ITS International.com).

Globally, the business model for these deployments has been a partnership between public and private enterprise, with the companies recovering the cost of the installation and maintenance of the systems from the penalties imposed on offenders over a period of time.

Worldwide, research on the effectiveness of automated traffic enforcement systems have shown an overall reduction in the number of fatalities and injuries due to road accidents. It has also made for a reliable and congestion free travel on roads .Overall it has aided in reduction of pollution as well as fuel consumption. These systems have encouraged people to be more disciplined on roads. Table 2 shows the reduction in fatalities due to installation of speed cameras across various cities.

Table 2. Reduction in fatalities due to installation of speed cameras across various cities.

Cities	Result of installation of speed cameras	Reduction %
West London	○ In three year, the result of cameras being operational on trunk roads were,	85% of the speed was reduced.
	• 226 fewer fatal or serious collisions	
	• 265 fewer killed people or serious injured	
Qatar	• Qatar showed that before the implementation from 2000–2006; mean (SD) vehicular injury death rate per 100,000 was 19.9±4.1.	25% reduction in vehicular death.
	• After cameras deployed from 2007 to 2010, mean (SD) vehicular death rates cut to 14.7±1.5.	
	○ After installation of speed cameras,	44% of the reduction in personal injury accidents.
Glasgow	• Red light running accidents have accounted for 20% of the decline.	
	• Personal injuries have accounted for 44% of the reduction in personal injury accidents.	

France	<ul style="list-style-type: none"> • The research on the fatalities data due to traffic accidents has shown a 51% reduction in 10 years. 	51% reduction in fatalities in 10 years.
	<ul style="list-style-type: none"> • National average speeds have fallen 12% between 2002 and 2009. 	
	<ul style="list-style-type: none"> ○ After installation of speed cameras, the reduction in all types of road accidents were, 	30% reduction in fatalities
Sweden	<ul style="list-style-type: none"> • 10% reduction in KSI 	
	<ul style="list-style-type: none"> • 30% reduction in road fatalities 	
Canada	<ul style="list-style-type: none"> • The need for speed cameras was realized in 1999 and in 10 years, 	13.3% reduction in fatalities.
	<ul style="list-style-type: none"> • intersection injury collisions decreased by 124 	
	<ul style="list-style-type: none"> • Fatalities decreased from 15 to 13 from November 2009 to 2010. 	

Table 3 shows the reduction in traffic congestion due to automated traffic enforcement systems.

Table 3. Reduction in traffic congestion due to automated traffic enforcement systems

Cities	Benefit of Automated traffic enforcement system
Singapore	Singapore expressways are tracked by EMAS. It uses a network of cameras to monitor vehicle speed and obstructions in expressways.
	All the electronic signboards on the expressway are displayed with heavy traffic flash messages. This helps in minimizing the congestions by asking the motorists to avoid those areas.
Sydney	Sydney adopted SCATS (Sydney Coordinated Adaptive Traffic System) to regulate the heavy inflow of traffic on its roads. SCAT ensures reduction in delay in traffic and also helps in the improvement of flow of traffic. A study done on the trial of SCATS in 1974 on Prince Highway Newton on 2.6 km arterial of Sydney showed a significant decrease in travel time.

METHODOLOGY

The key instrument for gathering data for this project was a 16 question survey that has been designed to analyze the impact of the SAHER system on drivers and residents. The survey took less than 10 minutes to complete and was provided to drivers and residents from Jeddah, Saudi Arabia. The sample size of 70 consisted of all male drivers and residents who have personally experienced the effect of the SAHER system while on the road. According to the Saudi law females are not allowed to hold a driver's license and drive.

The SAHER system has been implemented nationwide in Saudi Arabia; however, it was extremely difficult and expensive to collect data nationwide. This research did not have the resources necessary to conduct a nationwide study. Keeping this in mind, the focus of this study was the port city of Jeddah, the second largest city in Saudi Arabia. The city of Jeddah has a very diverse population and has a sample that represents the country adequately. Surveys were conducted with local sources having knowledge and experience with the SAHER system.

A facilitator was employed by the principle investigator to distribute the surveys among Saudi drivers in the city of Jeddah. The employed facilitator went to the department of traffic where driver licenses were issued and renewed. The facilitator was well-trained and understood fully the instructions provided by the principal investigator. After the surveys were completed, the employed facilitator mailed the surveys in a sealed envelope to the researcher.

The data was entered into and analyzed using Microsoft Excel. The survey had 16 questions. Each question was analyzed by calculating response percentages and means to

each question resulting from 5 point Likert scale using a 1 to 5 continuum. The measurement scale for questions 1 through 10 were as follow: Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither Agree nor Disagree (N) = 3, Agree (A) = 4, and Strongly Agree (SA) = 5. The measurement scale for questions 11 to 16 were as follow: Strongly Disagree (SD) = 5, Disagree (D) = 4, Neither Agree nor Disagree (N) = 3, Agree (A) = 2, and Strongly Agree (SA) = 1.

Conclusions for hypotheses 1 through 4 were determined by those means. If the mean was 3 or above, the perception was considered positive. If the mean was below 2, the perception was considered negative. If the mean was between 2 and 3, perception was inconclusive. Hypothesis 5 used a 2-tailed z-test to determine differences between two populations with a confidence level of 95%. Each age group had n=35. The significance of this test determined the retention or rejection of the null and alternate hypotheses. The survey questionnaire is included in appendix A.

Hypothesis 1 (SAHER has had a perceived influence on drivers in Saudi Arabia following safe driving rules.) was analyzed using survey question 1, 2, and 3. Hypothesis 2 (Saudi drivers perceived SAHER as helping Saudi police apprehend and punish traffic safety violators effectively.) was analyzed using survey question 4, 5, 6 and 7.

Hypothesis 3 (Saudi drivers perceived SAHER as a reliable system throughout those locations where implemented within the country.) was analyzed using survey question 8, 9, 10, 11 and 12. Hypothesis 4 (Saudi drivers perceived SAHER as having technical limitations where drivers may take advantage.) was analyzed using survey question 13, 14, 15 and 16. Table 4 shows all hypothesis and related questions of this research.

Table 4. Hypothesis and related questions.

Hypothesis	Questions
1- SAHER has had perceived influence on drivers in Saudi Arabia following safe driving rules.	<p>1. SAHER has reduced traffic fatalities in Saudi Arabia.</p> <p>2. SAHER has encouraged you to follow safe driving rules while on the road.</p> <p>3. SAHER has reduced accidents in Saudi Arabia.</p>
2- Saudi drivers perceive SAHER as helping Saudi police apprehend and punish traffic safety violators effectively.	<p>4. SAHER has helped the Saudi police force catch and punish violators effectively.</p> <p>5. SAHER has made the internal operations of the Saudi police force more efficient.</p> <p>6. SAHER has reduced the cost of the Saudi police force regarding traffic patrol.</p> <p>7. After SAHER was implemented, the Saudi police force patrol requirements have reduced.</p>
3- Saudi drivers perceive SAHER as a reliable system throughout those locations where implemented within the country.	<p>8. SAHER has had the same impact in all urban areas of Saudi Arabia.</p> <p>9. SAHER has standardized the traffic laws in all parts of Saudi Arabia where implemented.</p> <p>10. SAHER uses effective technology to reduce fatalities throughout the country.</p> <p>11. There are better systems than SAHER that could be implemented.</p> <p>12. Not all traffic violations are caught by SAHER.</p>
4- Saudi drivers perceive SAHER as having technical limitations where drivers may take advantage.	<p>13. SAHER can periodically malfunction.</p> <p>14. SAHER can be potentially hacked.</p> <p>15. SAHER has technical limitations of which drivers take advantage.</p> <p>16. The cameras used by SAHER are visible while driving</p>

5A- There was no difference in overall perception of SAHER between the two ages.

Computed using age group data

5B- There was a difference in overall perception of SAHER between the two ages.

ANALYSIS

The survey was completed by Saudi drivers in the city of Jeddah. The employed facilitator went to the department of traffic where driver licences were issued and renewed, and distributed the survey among drivers. All participants were males who were between the ages of 18-42. They were divided into two age groups of 18-30 and 31-42. The questionnaire was the same for each age group. The survey had 16 questions. Each question had a five point Likert scale. The measurement scale for questions 1 through 10 was as follows: Strongly Disagree (SD) = 1, Disagree (D) = 2, Neither Agree nor Disagree (N) = 3, Agree (A) = 4, and Strongly Agree (SA) = 5. The measurement scale for questions 11 to 16 was as follows: Strongly Disagree (SD) = 5, Disagree (D) = 4, Neither Agree nor Disagree (N) = 3, Agree (A) = 2, and Strongly Agree (SA) = 1. All data was analyzed using Microsoft Excel.

Question 1: SAHER has reduced traffic fatalities in Saudi Arabia.

For the first question, the first group which is between the ages of 18-30, 71.43% chose Strongly Agree, 17.14% chose Agree, 2.86% chose Neither Agree Nor Disagree, 5.71% chose Disagree, and 2.86% chose Strongly Disagree. The mean was 4.49.

The second group which is between the ages of 31-42, 54.29 % chose Strongly Agree, 28.57% chose Agree, none chose Neither Agree Nor Disagree, 11.43% chose Disagree, and 2.86% chose Strongly Disagree. The mean was 4.11. Figure 4 graphed the response to this question and indicated the difference between the two groups.

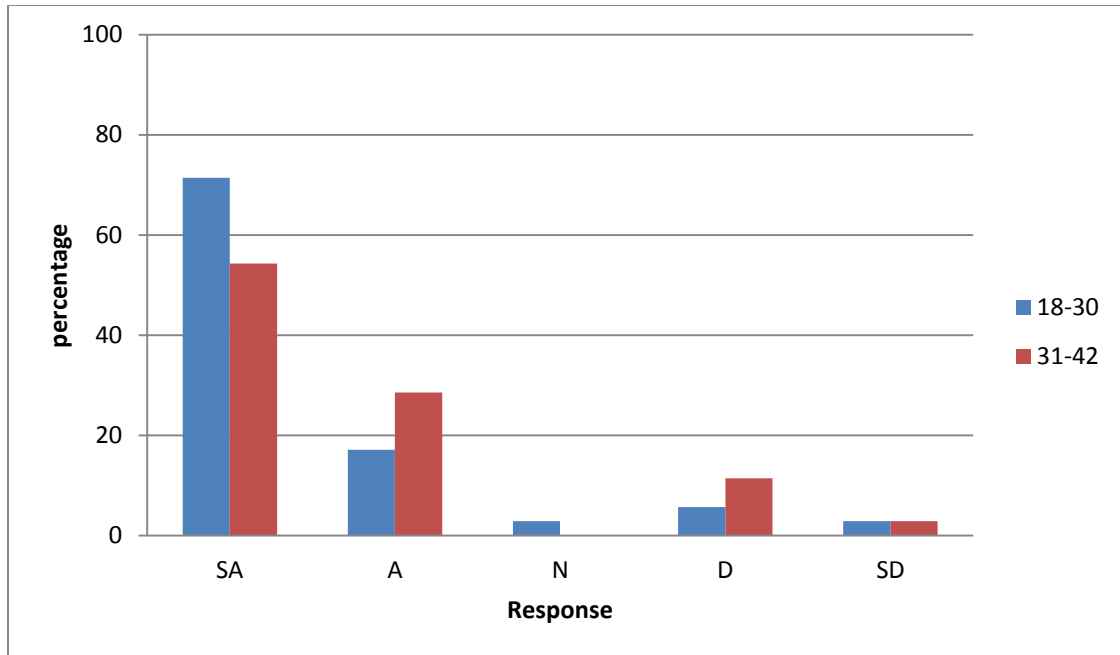


Figure 4. Graphed response to question 1, indicating the difference between the two age groups.

Question 2: SAHER has encouraged you to follow safe driving rules while on the road.

For the second question, the first group which is between the ages of 18-30, 48.57% chose Strongly Agree, 34.29% chose Agree, 11.43% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and 2.86% chose Strongly Disagree. The mean was 4.23.

The second group which is between the ages of 31-42, 34.29 % chose Strongly Agree, 37.14% chose Agree, 5.71% chose Neither Agree Nor Disagree, 17.14% of people chose Disagree, and 5.71% chose Strongly Disagree. The mean was 3.77. Figure 5 graphed of the response to this question and indicated the difference between the two groups.

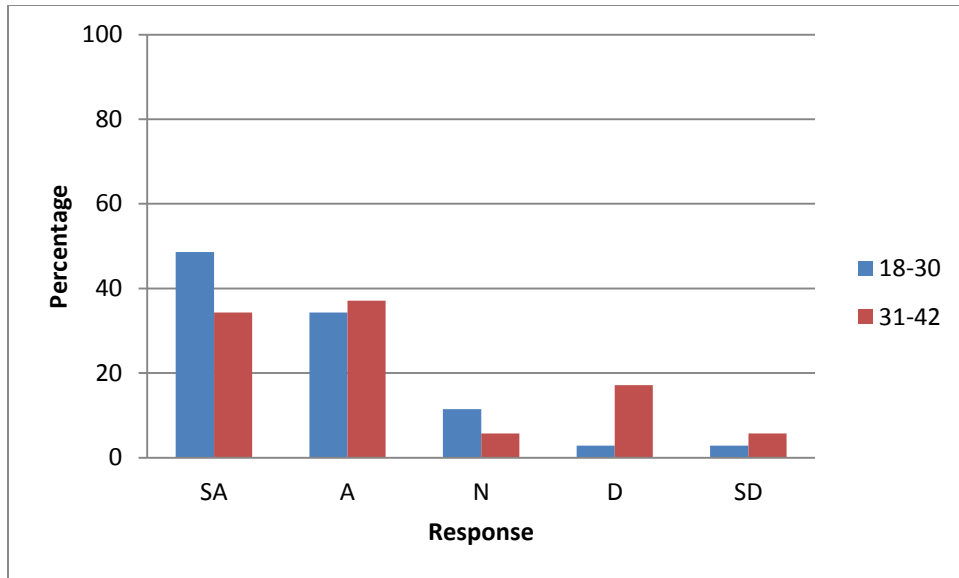


Figure 5. Graphed response to question 2, indicating the difference between the two age groups.

Question 3: SAHER has reduced accidents in Saudi Arabia.

For the third question, the first group which is between the ages 18-30, 68.57% chose Strongly Agree, 17.14% chose Agree, 11.43% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and none chose Strongly Disagree. The mean was 4.51.

The second group which is between the ages of 31-42, 57.14 % chose Strongly Agree, 20% chose Agree, 17.14% chose Neither Agree Nor Disagree, 5.71% of people chose Disagree, and 0% chose Strongly Disagree. The mean was 4.29. Figure 6 graphed of the response to this question and indicated the difference between the two groups.

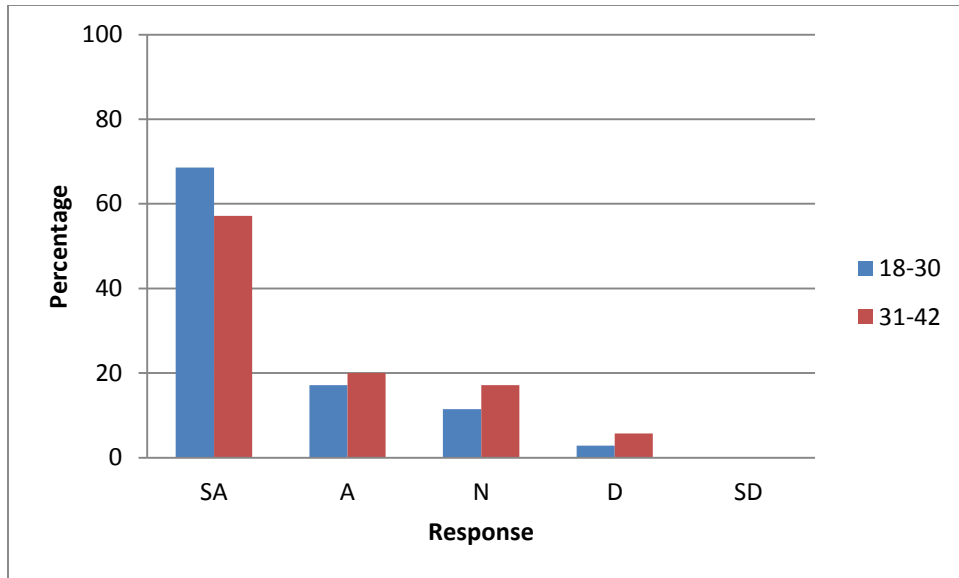


Figure 6. Graphed response to question 3, indicating the difference between the two age groups.

Question 4: SAHER has helped the Saudi police force catch and punish violators effectively.

For this question, the first group which is between the ages of 18-30, 57.14% chose Strongly Agree, 20% chose Agree, 11.43% chose Neither Agree Nor Disagree, 8.57% chose Disagree, and 2.86% of people chose Strongly Disagree. The mean was 4.2.

The second group which is between the ages of 31-42, results were 31.43 % chose Strongly Agree, 25.71% chose Agree, 17.14% chose Neither Agree Nor Disagree, 17.14% chose Disagree, and 8.75% of people chose Strongly Disagree. The mean was 3.54. Figure 7 graphed of the response to this question and indicated the difference between the two groups.

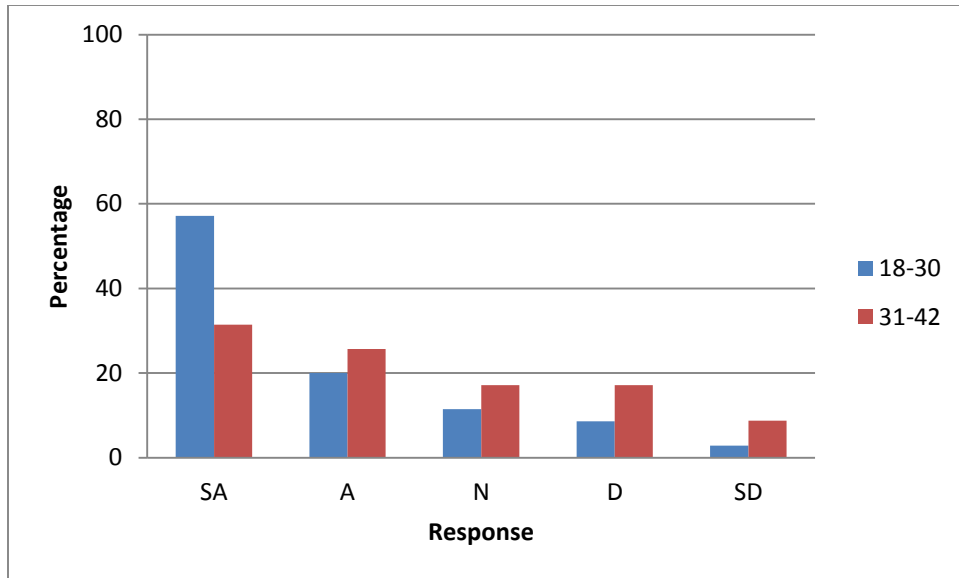


Figure 7 . Graphed response to question 4, indicating the difference between the two age groups.

Question 5: SAHER has made the internal operations of the Saudi police force more efficient.

For this question, the first group which is between the ages of 18-30, 51.43% chose Strongly Agree, 20% chose Agree, 11.43% chose Neither Agree Nor Disagree, 14.29% chose Disagree, and 2.86% of people chose Strongly Disagree. The mean was 4.03.

The second group which is between the ages of 31-42, 42.86 % chose Strongly Agree, 25.71% chose Agree, 14.29% chose Neither Agree Nor Disagree, 14.29% chose Disagree, 2.86% chose Strongly Disagree. The mean was 3.91. Figure 8 graphed of the response to this question and indicated the difference between the two groups.

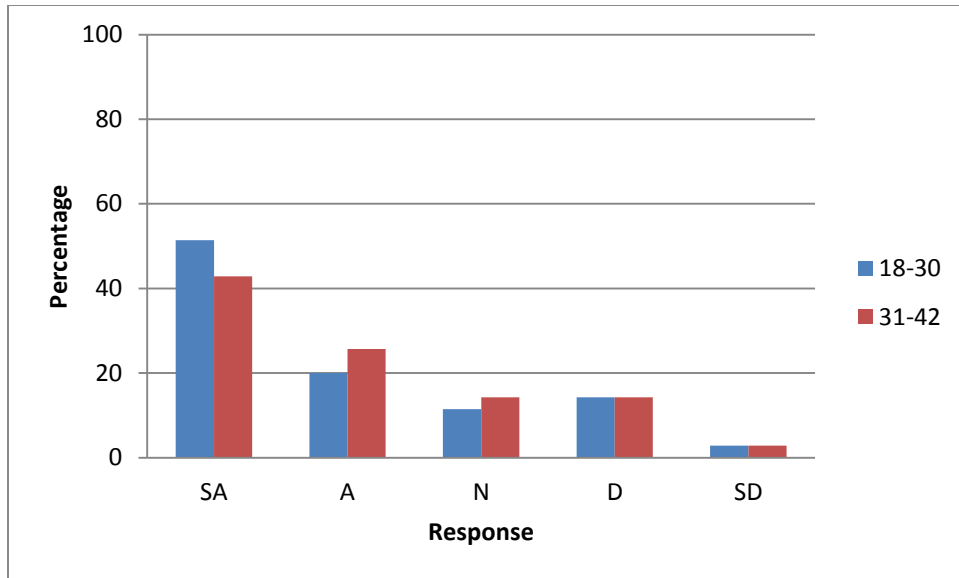


Figure 8. Graphed response to question 5, indicating the difference between the two age groups.

Question 6: SAHER has reduced the cost of the Saudi police force regarding traffic patrol.

For this question, the first group which is between the ages of 18-30, 14.29% chose Strongly Agree, 25.71% chose Agree, 34.29% chose Neither Agree Nor Disagree, 14.29% chose Disagree, and 11.43% chose Strongly Disagree. The mean was 3.17.

The second group which is between the ages of 31-42, 25.71% chose Strongly Agree, 34.29% chose Agree, 22.86% chose Neither Agree Nor Disagree, 8.57% chose Disagree, and 8.57% chose Strongly Disagree. The mean was 3.6. Figure 9 graphed of the response to this question and indicated the difference between the two groups.

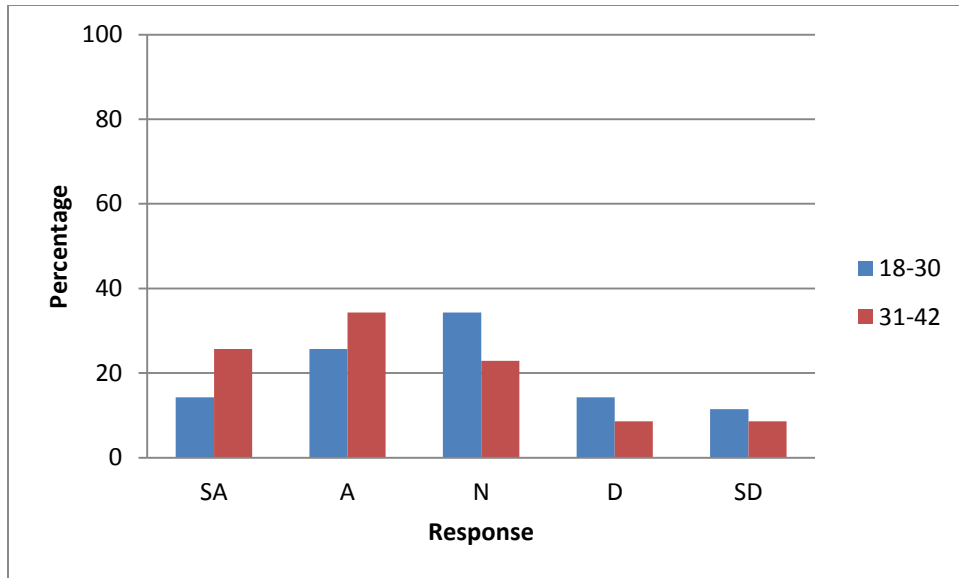


Figure 9. Graphed response to question 6, indicating the difference between the two age groups.

Question 7: After SAHER was implemented, the Saudi police force patrol requirements have reduced.

For this question, the first group which is between the ages of 18-30, 14.29% chose Strongly Agree, 11.43% chose Agree, 37.14% chose Neither Agree Nor Disagree, 20% chose Disagree, and 17.14% chose Strongly Disagree. The mean was 2.86.

The second group which is between the ages of 31-42, 14.29% chose Strongly Agree, 22.86% chose Agree, 20% chose Neither Agree Nor Disagree, 17.14% chose Disagree, and 25.71% chose Strongly Disagree. The mean was 2.83. Figure 10 graphed of the response to this question and indicated the difference between the two groups.

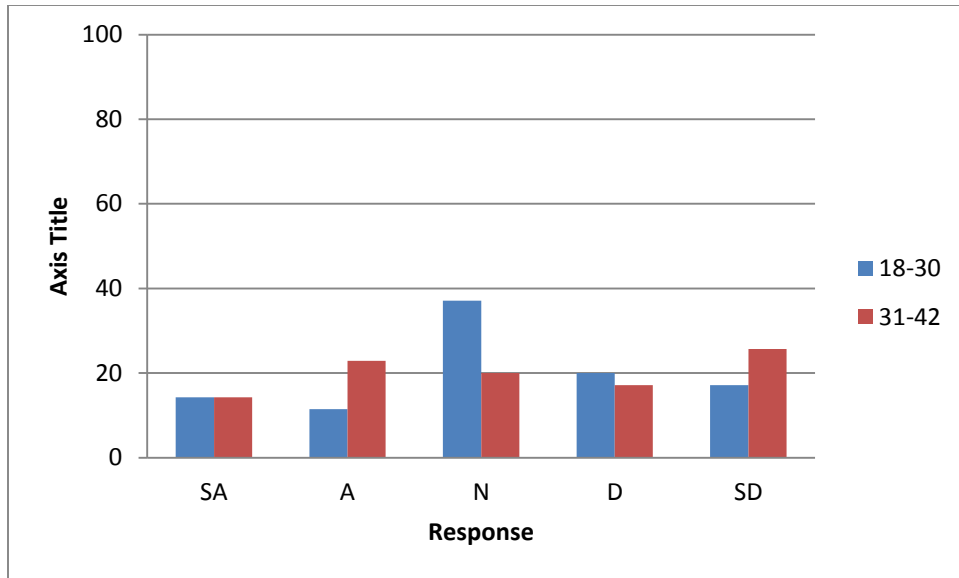


Figure 10. Graphed response to question 7, indicating the difference between the two age groups.

Question 8: SAHER has had the same impact in all urban areas of Saudi Arabia

For this question, the first group which is between the ages of 18-30, 34.29% chose Strongly Agree, 17.14% chose Agree, 34.29% chose Neither Agree Nor Disagree, 8.57% chose Disagree, and 5.71% chose Strongly Disagree. The mean was 3.66.

The second group which is between the ages of 31-42, 40% chose Strongly Agree, 28.57% chose Agree, 14.29% chose Neither Agree Nor Disagree, 14.29% chose Disagree, 2.86% chose Strongly Disagree. The mean was 3.89. Figure 11 graphed of the response to this question and indicated the difference between the two groups.

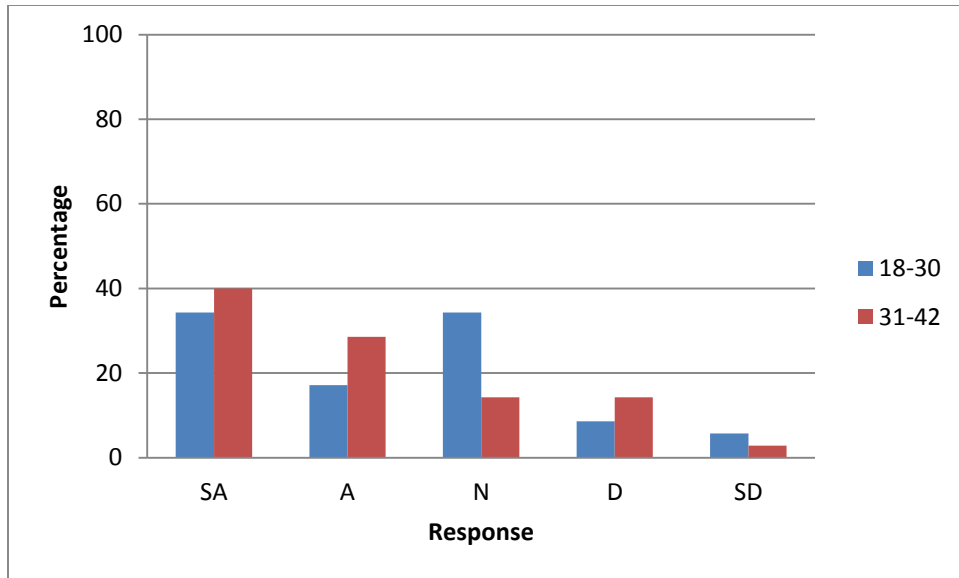


Figure 11. Graphed response to question 8, indicating the difference between the two age groups.

Question 9: SAHER has standardized the traffic laws in all parts of Saudi Arabia where implemented.

For this question, the first group which is between the ages of 18-30, 25.71% chose Strongly Agree, 25.71% chose Agree, 25.71% chose Neither Agree Nor Disagree, 14.29% chose Disagree, and 8.57% chose Strongly Disagree. The mean was 3.46.

The second group which is between the ages of 31-42, 42.86% chose Strongly Agree, 34.29% chose Agree, 11.43% chose Neither Agree Nor Disagree, 8.57% chose Disagree, and 2.86% chose Strongly Disagree. The mean was 4.06. Figure 12 graphed of the response to this question and indicated the difference between the two groups.

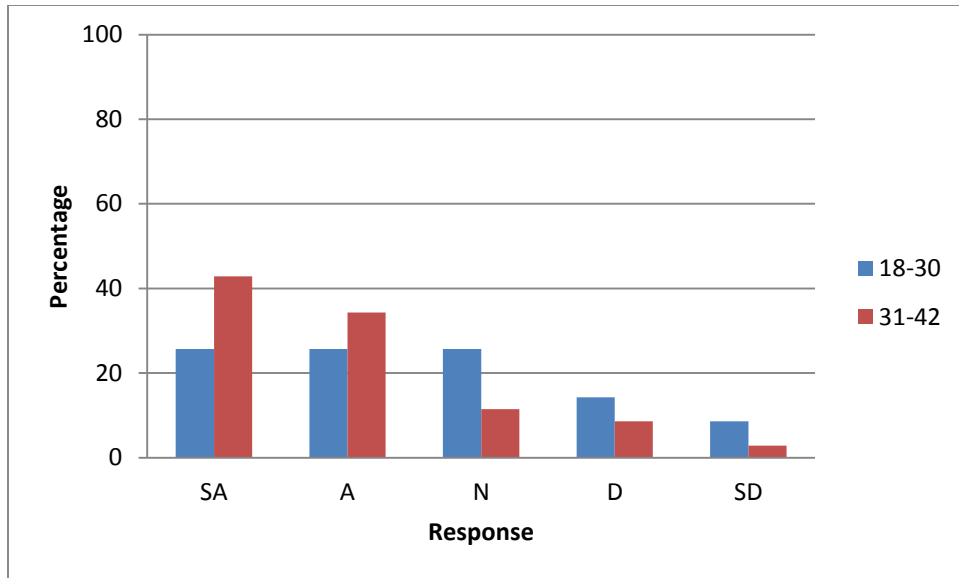


Figure 12. Graphed response to question 9, indicating the difference between the two age groups.

Question 10: SAHER uses effective technology to reduce fatalities thought the country

For this question, the first group which is between the ages of 18-30, 42.86% chose Strongly Agree, 31.43% chose Agree, 20% of people Neither Agree Nor Disagree, 5.71% chose Disagree, and 0% chose Strongly Disagree. The mean was 4.11.

The second group which is between the ages of 31-42, 42.86% chose Strongly Agree, 34.29% chose Agree, 8.57% chose Neither Agree Nor Disagree, 11.43% chose Disagree, and 2.86% chose Strongly Disagree. The mean was 4.03. Figure 13 graphed of the response to this question and indicated the difference between the two groups.

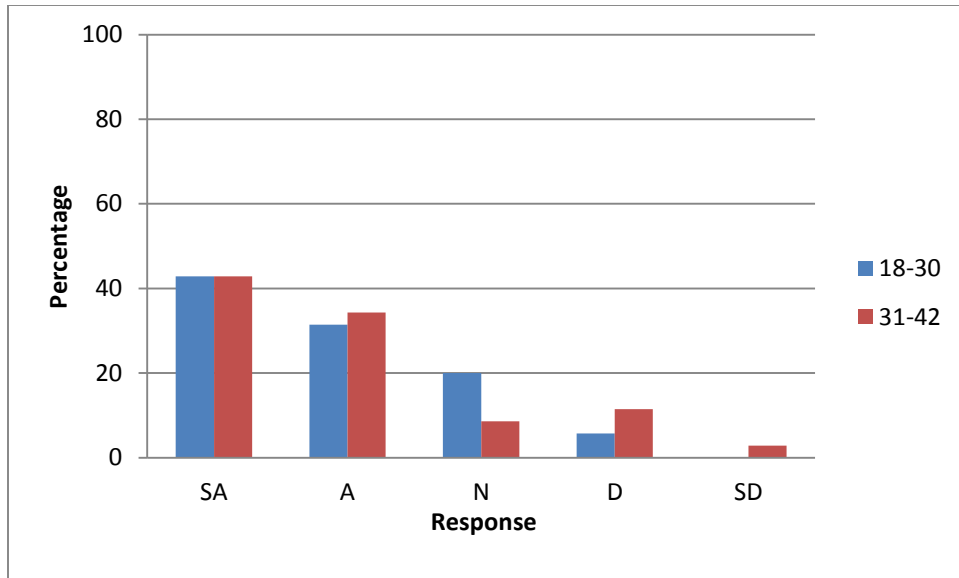


Figure 13. Graphed response to question 10, indicating the difference between the two age groups.

Question 11: There are better systems than SAHER that could be implemented

For this question, the first group which is between the ages of 18-30, 45.71% chose Strongly Agree, 8.57% chose Agree, 34.29% chose Neither Agree Nor Disagree, 5.71% chose Disagree, and 5.71% chose Strongly Disagree. The mean was 2.17.

The second group which is between the ages of 31-42, 28.57% chose Strongly Agree, 25.71% chose Agree, 34.29% chose Neither Agree Nor Disagree, 5.71% chose Disagree, and 5.71% chose Strongly Disagree. The mean was 2.34. Figure 14 graphed of the response to this question and indicated the difference between the two groups.

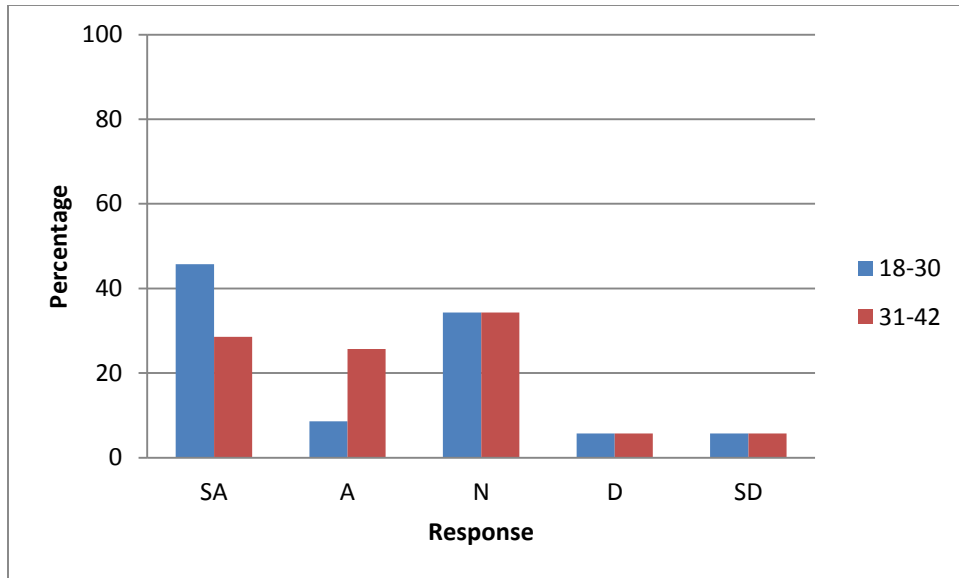


Figure 14. Graphed response to question 11, indicating the difference between the two age groups.

Question 12: Not all traffic violations are caught by SAHER.

For this question, the first group which is between the ages of 18-30, 51.43% chose Strongly Agree, 31.43% chose Agree, 8.57% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and 5.71% chose Strongly Disagree. The mean was 1.8.

The second group which is between the ages of 31-42, 62.86% chose Strongly Agree, 31.43% chose Agree, 2.86% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and 0% chose Strongly Disagree. The mean was 1.46. Figure 15 graphed of the response to this question and indicated the difference between the two groups.

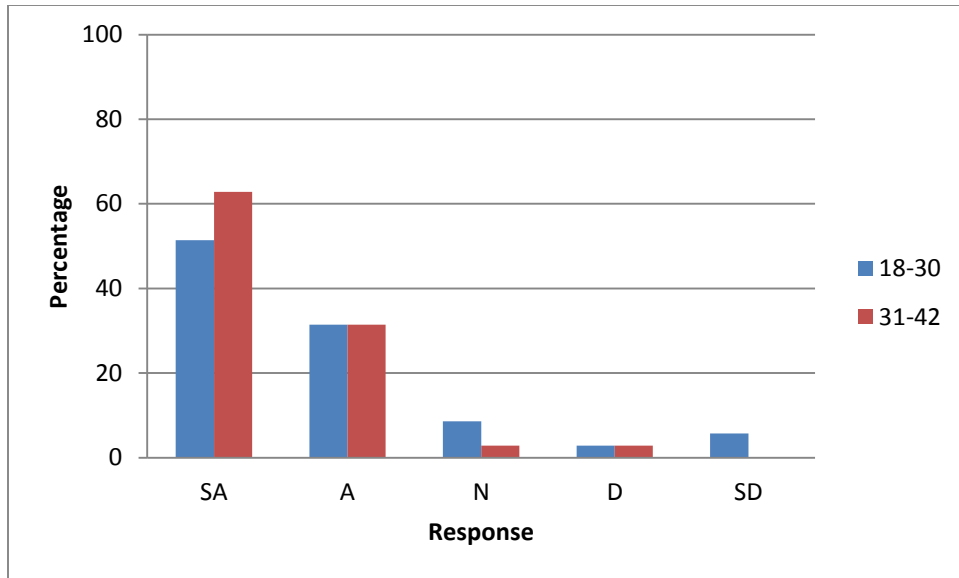


Figure 15. Graphed response to question 12, indicating the difference between the two age groups.

Question 13: SAHER can periodically malfunction.

For this question, the first group which is between the ages of 18-30, 40% chose Strongly Agree, 34.29% chose Agree, 20% chose Neither Agree Nor Disagree, 5.71% chose Disagree, and 0% chose Strongly Disagree. The mean was 1.91.

The second group which is between the ages of 31-42, 34.29% chose Strongly Agree, 45.71% chose Agree, 8.57% chose Neither Agree Nor Disagree, 5.71% chose Disagree, and 5.71% chose Strongly Disagree. The mean was 2.03. Figure 16 graphed of the response to this question and indicated the difference between the two groups.

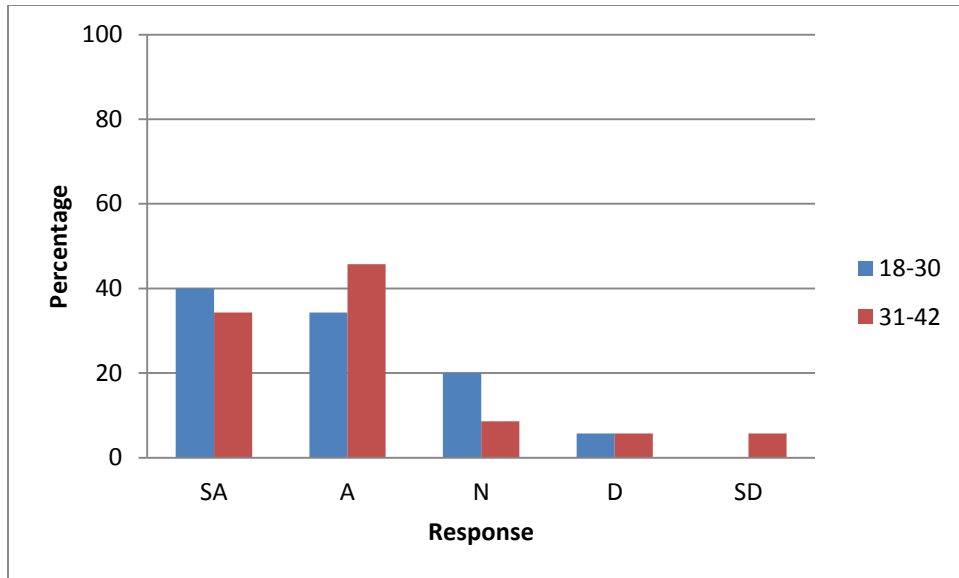


Figure 16. Graphed response to question 13, indicating the difference between the two age groups.

Question 14: SAHER can be potentially hacked.

For this question, the first group which is between the ages of 18-30, 22.86% chose Strongly Agree, 25.71% chose Agree, 40% chose Neither Agree Nor Disagree, 0% of chose Disagree, and 11.43% chose Strongly Disagree. The mean was 2.51.

The second group which is between the ages of 31-42, 28.57% chose Strongly Agree, 42.86% chose Agree, 22.86% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and 2.86% chose Strongly Disagree. The mean was 2.09. Figure 17 graphed of the response to this question and indicated the difference between the two groups.

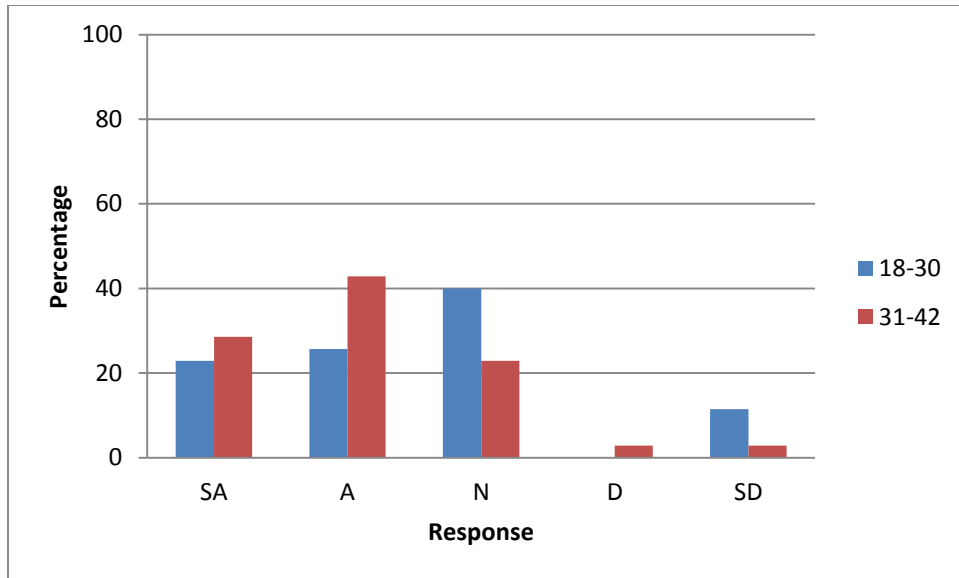


Figure 17. Graphed response to question 14, indicating the difference between the two age groups..

Question 15: SAHER has technical limitations of which drivers take advantage

For this question, the first group which is between the ages of 18-30, 40% chose Strongly Agree, 31.43% chose Agree, 11.43% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and 14.29% chose Strongly Disagree. The mean was 2.2.

The second group which is between the ages of 31-42, 34.29% chose Strongly Agree, 45.71% chose Agree, 11.43% chose Neither Agree Nor Disagree, 2.86% chose Disagree, and 5.71% chose Strongly Disagree. The mean was 2. Figure 18 graphed of the response to this question and indicated the difference between the two groups.

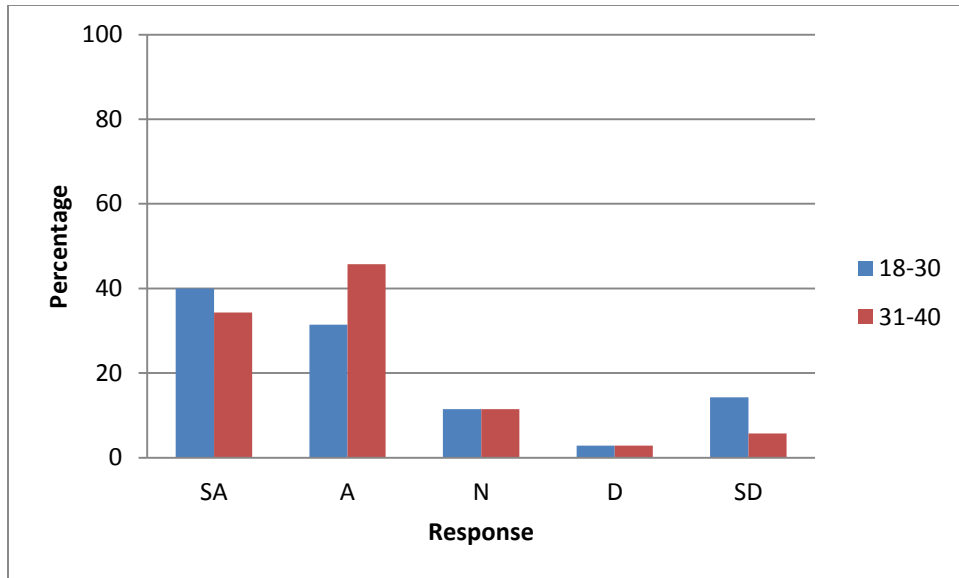


Figure 18. Graphed response to question 15, indicating the difference between the two age groups.

Question 16: The cameras used by SAHER are visible while driving.

For this question, the first group which is between the ages of 18-30, 11.43% chose Strongly Agree, 8.57% chose Agree, 5.71% chose Neither Agree Nor Disagree, 31.43% chose Disagree, and 42.86% chose Strongly Disagree. The mean was 3.86.

The second group which is between the ages of 31-42, 5.71% chose Strongly Agree, 14.29% chose Agree, 0% chose Neither Agree Nor Disagree, 31.43% chose Disagree, and 48.57% chose Strongly Disagree. The mean was 4.03. Figure 19 graphed of the response to this question and indicated the difference between the two groups.

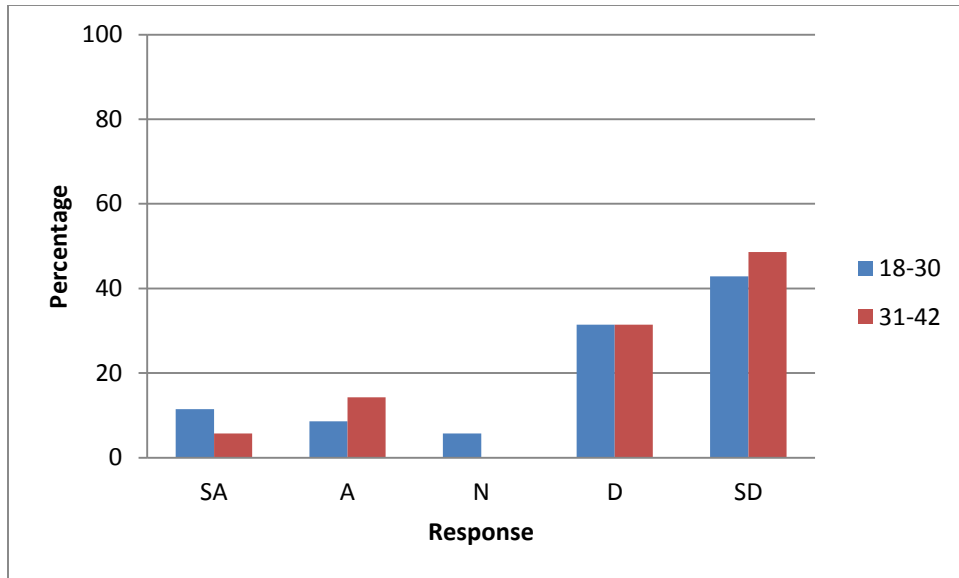


Figure 19. Graphed response to question 16, indicating the difference between the two age groups.

The means for each question and age group were tabulated (Table 5) and grand means and standard deviations of those means were calculated to provide analysis toward hypothesis 5.

Table 5. The means for each question.

No	Question	Age group between 18-30	Age group between 31-42
1	SAHER has reduced traffic fatalities in Saudi Arabia.	4.49	4.11
2	SAHER has encouraged you to follow safe driving rules while on the road.	4.23	3.77
3	SAHER has reduced accidents in Saudi Arabia.	4.51	4.29
4	SAHER has helped the Saudi police force catch and	4.20	3.54

	punish violators effectively.		
5	SAHER has made the internal operations of the Saudi police force more efficient.	4.03	3.91
6	SAHER has reduced the cost of the Saudi police force regarding traffic patrol.	3.17	3.60
7	After SAHER was implemented, the Saudi police force patrol requirements have reduced.	2.86	2.83
8	SAHER has had the same impact in all urban areas of Saudi Arabia.	3.66	3.89
9	SAHER has standardized the traffic laws in all parts of Saudi Arabia where implemented.	3.46	4.06
10	SAHER uses effective technology to reduce fatalities thought the country.	4.11	4.03
11	There are better systems than SAHER that could be implemented.	2.17	2.34
12	There are better systems than SAHER that could be implemented.	1.80	1.46
13	Not all traffic violations are caught by SAHER.	1.91	2.03
14	SAHER can periodically malfunction.	2.51	2.09
15	SAHER can be potentially hacked.	2.20	2.00
16	SAHER has technical limitations of which drivers take advantage.	3.86	4.03

Table 6 shows the mean and Standard Deviation for the age group between 18-30.

Table 6. The mean and Standard Deviation for the age group between 18-30.

Mean (X_1)	3.32
Standard Deviation (σ_1)	0.9551

Table 7 shows the mean and Standard Deviation for the age group between 31-42.

Table 7. The mean and Standard Deviation for the age group between 31-42.

Mean (X_2)	3.25
Standard Deviation (σ_2)	0.9534

Data for hypothesis 5 resulted with a Z score as follow.

- $$Z\text{-score (ZS)} = \frac{X_1 - X_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{3.32 - 3.25}{\sqrt{\frac{0.9551^2}{35} + \frac{0.9534^2}{35}}} = 0.307$$

Where: X_1 = the mean for the age group between 18-30.

X_2 = the mean for the age group between 31-42.

σ_1 = Standard Deviation for the age group between 18-30

σ_2 = Standard Deviation for the age group between 31-42.

CONCLUSION

The primary purpose of this study was to analyze the perceived impact of the SAHER system on overall traffic conditions in Jeddah, Saudi Arabia. This chapter draws conclusions regarding the hypotheses and overall thesis, and summarizes the findings providing potential explanation.

Hypotheses Conclusions

This study hypothesized on the Saudi drivers' perception of SAHER system in the city of Jeddah, Saudi Arabia. There were two different groups that participated in this research. All participants were male. The first group was between the ages of 18-30, and the second group was between the ages of 31-42. Each group was provided with the same questionnaire. The questionnaire is included in Appendix A. The hypotheses were divided into the following five sections.

Hypothesis 1: *SAHER has had a perceived influence on drivers in Saudi Arabia following safe driving rules.*

Survey questions 1,2, and 3 related to hypothesis one. The average mean between these three questions was 4.23. The conclusion for hypothesis one was positive in that SAHER has had a perceived influence on drivers in Saudi Arabia following safe driving rules.

Hypothesis 2: *Saudi drivers perceive SAHER as helping Saudi police apprehend and punish traffic safety violators effectively.*

Survey questions 4, 5, 6, and 7 are related to hypothesis two. The average mean between these four questions was 3.52. The conclusion for hypothesis two was positive in

that drivers in Saudi Arabia perceived SAHER as helping Saudi police apprehend and punish traffic safety violators effectively.

Hypothesis 3: *Saudi drivers perceive SAHER as a reliable system throughout those locations where implemented within the country.*

Questions 8, 9, 10, 11, and 12 pertained to hypothesis 3. The average mean between these four questions was 3.1. The conclusion for hypothesis 3 was positive in that Saudi drivers perceived SAHER as a reliable system throughout those locations where implemented within the country

Hypothesis 4: *Saudi drivers perceive SAHER as having technical limitations where drivers may take advantage.*

Questions, 13, 14, 15, and 16 pertained to hypothesis 4. The average mean between these four questions was 2.58. Hypothesis 4 was inconclusive in that Saudi drivers perceived SAHER as having technical limitations where drivers may take advantage of the system.

Hypothesis 5: *Ho5: There is no difference between the two age groups.*
Ha5: There is a difference between the two age groups.

The resulting test statistic of $z = 0.307$ compared to the two -tailed critical values of -1.95 and 1.95 with an α of 0.05 concluded with a retained null hypothesis. With a 95% confidence level, there was little difference between age group means regarding perception of the SAHER system as a reliable traffic control measure implemented by the Saudi government.

Overall Conclusion

This research studied the impact of SAHER system in Jeddah, Saudi Arabia and how drivers perceived the system. It showed that drivers in Jeddah, Saudi Arabia, had an overall positive perception that the SAHER system has had an impact on increasing road safety, has helped reduce loss of life and property damage, and has increased the productivity of traffic law enforcement agencies and individuals.

Recommendation for Further Study

From this research, it is recommended that similar studies be conducted in other major cities of Saudi Arabia and a similar study should also be conducted in rural areas. This will allow conclusions to have a broader representation and a more accurate analysis of the impact of the SAHER system in the country of Saudi Arabia. Also, additional questions that focus on further improvement of the SAHER system can be added to the existing survey. Such questions can focus on the advantages and disadvantages of the system and how to better educate Saudi citizens to follow safe driving rules.

Increasing the sample size can also improve the accuracy of the study in the future. Though this study primarily focused on the drivers, it will be interesting to see how the Saudi police officers view SAHER system. A key question to address in future studies will be to see if the SAHER system has increased efficiencies for the Saudi police. Lastly, the cost of implementing the system for the Saudi government was substantial. It will be important to find out what kind of returns the Saudi government is getting on their investment. This has to be measured in terms of the lives the system is helping to save on Saudi roads.

This study only looked at the role the SAHER system played in Jeddah, Saudi Arabia. To measure the overall effectiveness of the system it will be prudent to observe how the system is perceived in other major cities of Saudi Arabia.

APPENDIX A- THE SURVEY

Please answer honestly each of the statements below and to the best of your ability:

- What is your age?

18-30

31-42

o

o

Table 8. The survey questions.

No	Statement	Strongly Agree (5)	Agree (4)	Neither Agree nor Disagree (3)	Disagree (2)	Strongly Disagree (1)
1	SAHER has reduced traffic fatalities in Saudi Arabia.					
2	SAHER has encouraged you to follow safe driving rules while on the road.					
3	SAHER has reduced accidents in Saudi Arabia.					
4	SAHER has helped the Saudi police force catch and punish violators effectively.					
5	SAHER has made the internal operations of the Saudi police force more efficient.					
6	SAHER has reduced the cost of the Saudi police force regarding traffic patrol.					
7	After SAHER was implemented, the Saudi police force patrol requirements have reduced.					

8	SAHER has had the same impact in all urban areas of Saudi Arabia					
9	SAHER has standardized the traffic laws in all parts of Saudi Arabia where implemented.					
10	SAHER uses effective technology to reduce fatalities throughout the country					
11	There are better systems than SAHER that could be implemented					
12	Not all traffic violations are caught by SAHER					
13	SAHER can periodically malfunction					
14	SAHER can be potentially hacked.					
15	SAHER has technical limitations of which drivers take advantage					
16	The cameras used by SAHER are visible while driving					

Appendix B- SURVEY RESULTS

The results from the age group of 18-30.

Q	Strongly Agree	%	Agree	%	Neither Agree nor Disagree	%	Disagree	%	Strongly Disagree	%
1	25	71.43%	6	17.14%	1	2.86%	2	5.71%	1	2.86%
2	17	48.57%	12	34.29%	4	11.43%	1	2.86%	1	2.86%
3	24	68.57%	6	17.14%	4	11.43%	1	2.86%	0	0.00%
4	20	57.14%	7	20.00%	4	11.43%	3	8.57%	1	2.86%
5	18	51.43%	7	20.00%	4	11.43%	5	14.29%	1	2.86%
6	5	14.29%	9	25.71%	12	34.29%	5	14.29%	4	11.43%
7	5	14.29%	4	11.43%	13	37.14%	7	20.00%	6	17.14%
8	12	34.29%	6	17.14%	12	34.29%	3	8.57%	2	5.71%
9	9	25.71%	9	25.71%	9	25.71%	5	14.29%	3	8.57%
10	15	42.86%	11	31.43%	7	20.00%	2	5.71%	0	0.00%
11	16	45.71%	3	8.57%	12	34.29%	2	5.71%	2	5.71%
12	18	51.43%	11	31.43%	3	8.57%	1	2.86%	2	5.71%
13	14	40.00%	12	34.29%	7	20.00%	2	5.71%	0	0.00%
14	8	22.86%	9	25.71%	14	40.00%	0	0.00%	4	11.43%
15	14	40.00%	11	31.43%	4	11.43%	1	2.86%	5	14.29%
16	4	11.43%	3	8.57%	2	5.71%	11	31.43%	15	42.86%

Appendix C- SURVEY RESULTS

The results from the age group of 30-42

Q	Strongly Agree	%	Agree	%	Neither Agree nor Disagree	%	Disagree	%	Strongly Disagree	%
1	19	54.29%	10	28.57%	0	0.00%	4	11.43%	1	2.86%
2	12	34.29%	13	37.14%	2	5.71%	6	17.14%	2	5.71%
3	20	57.14%	7	20.00%	6	17.14%	2	5.71%	0	0.00%
4	11	31.43%	9	25.71%	6	17.14%	6	17.14%	3	8.57%
5	15	42.86%	9	25.71%	5	14.29%	5	14.29%	1	2.86%
6	9	25.71%	12	34.29%	8	22.86%	3	8.57%	3	8.57%
7	5	14.29%	8	22.86%	7	20.00%	6	17.14%	9	25.71%
8	14	40.00%	10	28.57%	5	14.29%	5	14.29%	1	2.86%
9	15	42.86%	12	34.29%	4	11.43%	3	8.57%	1	2.86%
10	15	42.86%	12	34.29%	3	8.57%	4	11.43%	1	2.86%
11	10	28.57%	9	25.71%	12	34.29%	2	5.71%	2	5.71%
12	22	62.86%	11	31.43%	1	2.86%	1	2.86%	0	0.00%
13	12	34.29%	16	45.71%	3	8.57%	2	5.71%	2	5.71%
14	10	28.57%	15	42.86%	8	22.86%	1	2.86%	1	2.86%
15	12	34.29%	16	45.71%	4	11.43%	1	2.86%	2	5.71%
16	2	5.71%	5	14.29%	0	0.00%	11	31.43%	17	48.57%

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